

NFPA 1144
Standard for
Protection of Life and Property from Wildfire
2002 Edition

Copyright © 2002, National Fire Protection Association, All Rights Reserved

This edition of NFPA 1144, *Standard for Protection of Life and Property from Wildfire*, was prepared by the Technical Committee on Forest and Rural Fire Protection and acted on by NFPA at its May Association Technical Meeting held May 19–23, 2002, in Minneapolis, MN. It was issued by the Standards Council on July 19, 2002, with an effective date of August 8, 2002, and supersedes all previous editions.

This edition of NFPA 1144 was approved as an American National Standard on July 19, 2002.

Origin and Development of NFPA 1144

NFPA 1144, *Standard for Protection of Life and Property from Wildfire*, was first developed by the Forest and Rural Fire Protection Committee, following the tragic wildfires that resulted in the loss of 44 lives and 1400 homes in the United States in 1985. More recent wildland/urban interface fires, such as the 1991 conflagration in Oakland, CA and the fires in Laguna Beach, CA (1993), and Malibu, CA (1996), have demonstrably shown that fire fighters are often placed in dangerous situations due to inadequate planning and design of roadways, signs, water supplies, and other infrastructure considerations as well as the increasing population of residential areas encroaching into wildland areas. The fire season of 2000 resulted in renewed interest for seeking more creative alternative methods to reduce historical trends of catastrophic fires.

Originally numbered NFPA 299, this document has been officially adopted by state and local governments and adapted for use by numerous jurisdictions involved in planning Firewise Communities. This edition, which has been renumbered as NFPA 1144, includes clarification of numerous requirements in the earlier editions and a significant revision of the Wildland Fire Risk and Hazard Severity Assessment system. The Committee increased the severity values for non-rated roofing, inadequate separation of vegetation from structures, and separation of structures from one another. The Committee tested various assessment system versions in several Firewise Communities Workshops, sponsored by the National Wildland/Urban Interface Fire Program, before arriving at the relative values and hazard

Copyright NFPA

levels in this document. The Committee supports use of these values as relative numbers for planning purposes.

This standard presents basic criteria for fire agencies, land use planners, architects, developers, and local government for planning development in areas that may be threatened by wildfire. This standard, when used in a cooperative approach among key disciplines, will provide guidance in the design and development of Firewise Communities in or near wildland fire prone areas. It is hoped that the requirements set forth in this document will, first, help protect the lives of both residents and fire fighters when wildfires strike and, second, reduce property damage.

Technical Committee on Forest and Rural Fire Protection

Nanette L. McElman, *Chair*
Institute for Business & Home Safety, FL

John E. Bunting, *Secretary*
New Boston Fire Department, NH [U]

Fred G. Allinson, WA [U]
Rep. National Volunteer Fire Council

Lynn R. Biddison, Fire-Trol Holdings LLC, AZ [IM]

Kenneth S. Blonski, University of California, CA [RT]

James D. Bowman, American Forest & Paper Association, WA [M]
Rep. American Forest & Paper Association

Randall K. Bradley, Lawrence Livermore National Lab, CA [U]

Mary D. Chambers, Bernalillo County Fire District 10, NM [U]

Alice R. Forbes, USDA Forest Service, CA [E]

Donald C. Freyer, GA [SE]

Charles W. George, Frenchtown, MT [SE]

Fort Hartsfield, Committee for Firesafe Dwellings, CA [SE]

Mitchell J. Hubert, Tyco Suppression Systems, WI [M]

Louis G. Jekel, Rural/Metro Fire Department, AZ [U]

Roy A. Johnson, U.S. Department of the Interior, ID [E]

Russell G. Johnson, Environmental Systems Research Institute, CA [RT]

Gregory Kozey, Kocheck Company, Inc., CT [M]

Daniel Madrzykowski, National Institute of Standards and Technology, MD [RT]

Kenneth J. Miller II, California Dept. of Forestry and Fire Protection, CA [E]

William M. Neville, Jr., Neville Associates, CA [SE]

Martin J. Pabich, Underwriters Laboratories Inc., IL [RT]

Frederick S. Richards, New York Department of State, OFPC, NY [E]
Rep. International Fire Marshals Association

Herbert A. Spitzer, Jr., Los Angeles County Fire Department, CA [U]

Edward F. Straw, Insurance Services Office, Inc., GA [I]

Howard L. Vandersall, Lawdon Fire Services, Inc., CA [SE]

James T. Wooters, Mizelle, Hodges and Associates Inc., GA [SE]

Alternates

James A. Burns, New York Department of State, NY [E]
(Alt. to F. S. Richards)

Philip A. Cocker, Los Angeles County Fire Department, CA [U]
(Alt. to H. A. Spitzer)

Robert L. Crouch, Fire-Trol Holdings LLC, AZ [IM]
(Alt. to L. R. Biddison)

Sam W. Francis, American Forest & Paper Association, PA [M]
(Alt. to J. D. Bowman)

Curt T. Grieve, CA [M]
(Voting Alt. to SRMA Rep.)

Peter Matulonis, Tyco Suppression Systems, CA [U]
(Alt. to M. J. Hubert)

Emil W. Misichko, Underwriters Laboratories Inc., IL [RT]
(Alt. to M. J. Pabich)

Robert M. Swinford, USDA Forest Service, DC [E]
(Alt. to A. R. Forbes)

William D. Walton, National Institute of Standards and Technology, MD [RT]
(Alt. to D. Madrzykowski)

Louis A. Witzeman, Scottsdale Fire Department, AZ [U]
(Alt. to L. G. Jekel)

James C. Smalley, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on fire protection for rural, suburban, forest, grass, brush, and tundra areas. This Committee shall also have primary responsibility for documents on Class A foam and its utilization for all wildland and structural fire fighting. This excludes fixed fire protection systems.

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

NFPA 1144
Standard for
Protection of Life and Property from Wildfire
2002 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, Annex C lists the complete title and edition of the source documents for both mandatory and nonmandatory extracts. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the appropriate technical committee.

Information on referenced publications can be found in Chapter 2 and Annex C.

Chapter 1 Administration

1.1 Scope.

This standard shall be used to provide minimum planning, construction, maintenance, education, and management elements for the protection of life, property, and other values that could be threatened by wildland fire.

Copyright NFPA

1.2 Purpose.

This standard shall be used to provide minimum requirements for planning, construction, maintenance, fire prevention, and management to parties responsible for fire protection, land use planning, property development, property maintenance, and others responsible for or interested in improving fire and life safety in areas where wildland fire could threaten lives, property, and other values.

1.3 Application.

1.3.1 This standard shall not be construed as prohibiting any construction or planning features that will provide fire protection at least as equivalent to that required by this standard and that which has been set forth by the authority having jurisdiction (AHJ).

1.3.2 This standard shall not be used to set forth the general fire protection features or procedures addressed in other standards.

1.3.3 The authority having jurisdiction shall use recognized fire protection measures to meet local conditions.

1.3.4 When unusual local conditions exist, the authority having jurisdiction shall determine equivalent requirements that provide a level of protection no less than would be afforded by full compliance with this standard.

Chapter 2 Referenced Publications

2.1 General.

The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2002 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2000 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2001 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, 2000 edition.

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, 2001 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System*, 2002 edition.

Copyright NFPA

2.3 Other Publications.

2.3.1 AWWA Publications.

American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.

AWWA Standard C-502, *Dry Barrel Fire Hydrants*.

AWWA Standard C-503, *Wet Barrel Fire Hydrants*.

Chapter 3 Definitions

3.1 General.

The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not included, common usage of the terms shall apply.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

3.2.3* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.4 Shall. Indicates a mandatory requirement.

3.2.5 Standard. A document, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

3.3.1 Accessory Structure. Any structure used incidentally to another structure.

3.3.2 Alternative. A system, condition, arrangement, material, or equipment submitted to the authority having jurisdiction as a substitute for a requirement in a standard.

3.3.3 Aspect. Compass direction toward which a slope faces.

3.3.4 Building. Any structure used or intended for supporting or sheltering any use or occupancy. [101:3.3]

3.3.5 Combustible. Any material that, in the form in which it is used and under the
Copyright NFPA

conditions anticipated, will ignite and burn or will add appreciable heat to an ambient fire.

3.3.6 Defensible Space. An area as defined by the AHJ [typically a width of 9.14 m (30 ft) or more] between an improved property and a potential wildland fire where combustible materials and vegetation have been removed or modified to reduce the potential for fire on improved property spreading to wildland fuels or to provide a safe working area for fire fighters protecting life and improved property from wildland fire.

3.3.7 Dry Hydrant. An arrangement of pipe permanently connected to a water source other than a piped, pressurized water supply system that provides a ready means of water supply for fire-fighting purposes and that utilizes the drafting (suction) capability of fire department pumpers.

3.3.8 Dwelling. One or more living units, each providing complete and independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

3.3.9 Evacuation. The temporary movement of people and their possessions from locations threatened by wildland fire.

3.3.10 Fire Hazard. A fuel complex, defined by kind, arrangement, volume, condition, and location, that determines the ease of ignition and/or resistance to fire control.

3.3.11 Fire Hydrant. A valved connection on a water supply system having one or more outlets and that is used to supply hose and fire department pumpers with water. [1141:2.1]

3.3.12 Fire-Resistant Construction. Construction designed to offer reasonable protection against fire.

3.3.13 Fuel Modification. Any manipulation or removal of fuels to reduce the likelihood of ignition or the resistance to fire control.

3.3.14* Fuels. All combustible materials within the wildland/urban interface or intermix, including but not limited to vegetation and structures.

3.3.15 Ground Fuels. All combustible materials such as grass, duff, loose surface litter, tree or shrub roots, rotting wood, leaves, peat, or sawdust that typically support combustion.

3.3.16 Improved Property. A piece of land or real estate upon which a structure has been placed, a marketable crop is growing (including timber), or other property improvement has been made.

3.3.17 Mitigation. Action that moderates the severity of a fire hazard or risk.

3.3.18 Noncombustible. Any material that, in the form in which it is used and under the conditions anticipated, will not ignite and burn nor will add appreciable heat to an ambient fire.

3.3.19 Occupancy. The purpose for which a building or portion thereof is used or intended to be used. [101:3.3]

3.3.20 Risk. The chance of a fire starting from any cause.

3.3.21 Road. Any accessway, not including a driveway, that gives access to more than one parcel and is primarily intended for vehicular access.

3.3.22* Slope. Upward or downward incline or slant, usually calculated as a percentage.

3.3.23 Structure. That which is built or constructed. [101:3.3]

3.3.24 Turnaround. A portion of a roadway, unobstructed by parking, that allows for a safe reversal of direction for emergency equipment.

3.3.25 Turnouts. A widening in a travelway of sufficient length and width to allow vehicles to pass one another.

3.3.26 Water Supply. A source of water for fire-fighting activities.

3.3.27 Wildland Fire. An unplanned and uncontrolled fire spreading through vegetative fuels, at times involving structures.

3.3.28 Wildland/Urban Interface. An area where improved property and wildland fuels meet at a well-defined boundary.

3.3.29 Wildland/Urban Intermix. An area where improved property and wildland fuels meet with no clearly defined boundary.

Chapter 4 Assessment and Planning

4.1 General.

4.1.1 When the AHJ determines that existing improved property is, or a planned property improvement will be, located in a wildland/urban interface or intermix area, the AHJ shall perform, or cause to be performed, a wildland fire risk and hazard severity analysis of the area to determine relative risk and hazard ratings.

4.1.2 The analysis shall, as a minimum, include the following:

- (1) Identification and documentation of wildland fire risk and hazard areas
- (2) Establishment of priorities relative to mitigating the dangers from wildland fire
- (3) Determination of mitigation measures for vegetation, other combustibles, and construction criteria

4.2* Risk and Hazard Severity Analysis.

4.2.1 General.

4.2.1.1 A risk and hazard rating analysis shall be performed to determine the level of the wildland fire threat to life and values at risk.

4.2.1.2 The risk and hazard ratings shall be the basis for the implementation of mitigation measures relative to vegetation, other combustibles, and construction criteria.

4.2.1.3 As a minimum, the rating system shall contain the rating factors covered in 4.2.2.

4.2.2 Analysis Rating Factors.

4.2.2.1 The history of local wind, relative humidity, temperature, and fine fuel moisture content shall be considered in determining defensible space.

4.2.2.2* All vegetative fuels and other combustible materials shall be evaluated for their potential to contribute to the intensity and spread of wildland fire.

4.2.2.3 A structure that fails to comply with the requirements of Chapter 8 shall be deemed to increase the risk of the spread of wildland fire to life and improved property and the risk of fires on improved property spreading to wildland fuels.

4.2.2.4* Slope and aspect shall be evaluated as to their potential to increase the threat of wildland fire to life or improved property.

4.2.2.5 The factors determining required defensible space shall include the history of wildland fire for the area.

4.2.2.6 Fire-safe routes for emergency service apparatus and for egress shall be evaluated.

4.2.2.7* Other factors that can affect the risk of ignition or the spread of wildland fire on improved property, including the risk of structure fires spreading to vegetation, shall be part of the analysis.

4.3 Review of Wildland Fire Risk and Hazard Rating.

The rating assignments developed to meet the requirements of this chapter shall be reviewed annually and updated as required.

4.4 Development of Wildland Fire Risk and Hazard Mitigation Plan.

4.4.1 The AHJ shall require or cause to be developed a plan to address the risk and hazards identified in the analysis.

4.4.2 This plan shall include, but not be limited to, the following:

- (1) Access, ingress, egress, and evacuation
- (2) Fuel modification
- (3) Water supply
- (4) Construction, location, and design of structures
- (5) Ignition potential

4.4.3 The AHJ shall approve the mitigating measures relative to access, defensible space, water supply, and construction based upon the relative risk and hazard rating established in 4.1.2.

4.4.4 No permit associated with construction or occupancy shall be issued until the provisions of this standard are satisfied.

4.5 Construction Documents.

Copyright NFPA

4.5.1 The AHJ shall be provided with plans and specifications for each project regulated by this standard.

4.5.2 The construction documents shall clearly indicate the methods, materials, and processes employed to meet the requirements of this standard and the location of each structure or feature drawn to scale.

4.5.3 The construction documents shall include a vicinity map that includes details regarding the vicinity within 91.4 m (300 ft) of property lines, including other structures, slope, vegetation, fuel breaks, water supply systems, and access roads.

Chapter 5 Access, Ingress, Egress, and Evacuation

5.1 Roads.

5.1.1 Access for emergency responders, ingress, egress, and evacuation shall be provided for all buildings.

5.1.2 Roads shall be designed and constructed to allow evacuation simultaneously with emergency response operations.

5.1.3 Roads shall be not less than 6.1 m (20 ft) of unobstructed width with a 4.1 m (13.5 ft) vertical clearance.

5.1.4 Parking shall be allowed only where an additional 2.7 m (9 ft) of improved road width is provided and only within that improved width.

5.1.5 Roads shall be designed, constructed, and maintained to accommodate the load and turning radius of the largest apparatus typically used to respond to that location.

5.1.6 Roads shall have no grade in excess of 10 percent.

5.1.6.1 Steeper grades shall be permitted by the AHJ where mitigation measures can be agreed upon jointly by the fire and road engineering departments.

5.1.7* Dead-end roads in excess of 91.4 m (300 ft) in length shall be provided with turnouts and turnarounds as approved by the AHJ.

5.1.8 Every dead-end fire service access road more than 91.4 m (300 ft) in length shall be provided with a turnaround at the terminus having a minimum radius of 15.2 m (50 ft) to the center line. The AHJ shall be authorized to approve, as an alternative, a “hammerhead T” turnaround to provide emergency vehicles with a three-point turnaround ability.

5.2 Driveways.

5.2.1 Where any point of a building is greater than 45.7 m (150 ft) from a road, a driveway shall be provided to within 45.7 m (150 ft) of the building.

5.2.2 Where the driveway is greater than 45.7 m (150 ft) in length, it shall be not less than 3.7 m (12 ft) in unobstructed width with 4.1 m (13.5 ft) in vertical clearance.

5.2.3* Where the driveway is greater than 91.4 m (300 ft), it shall be provided with turnouts or turnarounds at locations approved by the AHJ.

5.2.4 Required driveways shall have a grade not to exceed 10 percent.

5.2.4.1 Steeper grades shall be permitted by the AHJ where mitigation measures can be agreed upon jointly by the AHJ and the property owner.

5.3 Bridges.

5.3.1 Any bridge on a road or required driveway shall be designed to accommodate the load of the largest apparatus typically used to respond to that location.

5.3.2 The load limit shall be clearly posted at the approaches to the bridge.

5.4 Gates.

5.4.1 Any gate on a required road or driveway shall be located a minimum of 9.14 m (30 ft) from the intersection of the road or driveway.

5.4.2 The gate opening shall swing inward and shall provide a clear opening no less than 0.61 m (2 ft) wider than the gated road or driveway.

5.4.3 Emergency responders shall have ready access to locking mechanisms on any gate that restricts access.

5.5 Fire Lanes.

Fire lanes shall be provided as required by the AHJ.

5.6 Signs.

5.6.1* Roads, fire service access, dwellings, and commercial structures shall be identified by a consistent identification system that provides for sequenced or patterned numbering and nonduplicated naming within each jurisdiction.

5.6.1.1 In cases where the AHJ is not a fire department, the fire department shall be consulted prior to the issuance of the name and/or number.

5.6.1.2 All letters, numbers, and symbols shall be a minimum of 102 mm (4 in.) in height, with a 12.7-mm (½-in.) stroke, and shall be reflectorized and contrasting with the background color of the sign.

5.6.1.3 Signs shall be visible from the road and mounted not less than 1.8 m (6 ft) nor more than 1.8 m to 2 m (6 ft to 8 ft) above the surface of the road, unless local conditions or existing standards prescribe otherwise.

5.6.1.4 Street and road name signs and supporting structures shall be of noncombustible materials.

Chapter 6 Fuel Modification Area

6.1 General.

When the Wildland Fire Risk and Hazard Mitigation Plan requires establishment of a fuel modification area, the modifications shall extend at least 9.14 m (30 ft) from structures.

6.2 Fuels Modification/Treatment.

6.2.1* Ground fuels within the defined defensible space shall be treated or removed.

6.2.2 Live vegetation within the defensible space shall have dead material removed and shall be thinned and pruned.

6.2.3 Dead and/or downed fuels within the defensible space of buildings shall be removed or treated to maintain the fuel modification area.

6.2.4 Vegetation under trees within the fuel modification area shall be maintained at a height that will preclude ground fire from spreading in the tree crown.

6.2.5 The fuel modification plan shall include a maintenance element with the responsibility for maintenance defined.

6.3 Combustible Materials.

6.3.1 Propane tanks and other combustible liquids storage shall conform to NFPA 30, *Flammable and Combustible Liquids Code*, NFPA 58, *Liquefied Petroleum Gas Code*, and the Wildland Fire Risk and Hazard Mitigation Plan required in Section 4.4.

6.3.2 Other combustible materials shall be removed from the defensible space or stored in conformance with the fire protection plan as approved by the AHJ (*see 4.4.1*).

Chapter 7 Water Supply

7.1 Minimum Water Supply Requirements.

7.1.1 At a minimum, every building shall be provided with a water supply meeting the requirements of NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, for the purpose of fire fighting.

7.1.2 Private fire service mains and hydrants shall be installed to meet the requirements of NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*.

7.1.3 Threads on all fire hydrant outlets shall be American National Fire Hose Connection Screw Threads and shall be equipped with thread adapters where local fire department thread is different.

7.1.4 Fire hydrants shall meet the requirements of AWWA Standards C-502, *Dry Barrel Fire Hydrants*, or C-503, *Wet Barrel Fire Hydrants*.

7.1.5 Dry fire hydrants shall meet the requirements of NFPA 1142, *Standard on Water*

7.2 Acceptance.

The contractor or installer of water supply systems shall demonstrate by actual test that the capacity of the water supply system will meet fire protection design requirements.

Chapter 8 Building Design, Location, and Construction

8.1 Construction in Wildland Areas.

8.1.1 General.

8.1.1.1 All buildings potentially threatened by wildland fire shall be designed, located, and constructed to comply with this standard and/or one of the model building standards.

8.1.1.2 In case of conflict between the local building standard and this standard, the more stringent fire protection requirements shall be utilized to mitigate the combustibility of structures exposed to potential wildland fire.

8.1.2* Location. Buildings located closer than 9.14 m (30 ft) to a vegetated slope shall require special mitigation measures as determined by the AHJ.

8.2* Roof Design and Materials.

8.2.1 The requirements for roof covering assemblies shall be as follows:

- (1) Only roof covering assemblies rated Class A, B, or C shall be used.
- (2) The specific class shall be consistent with the wildland fire risk and hazard severity assessment as determined by the AHJ. *(See A.4.2.)*

8.2.2* Vents shall be screened with a corrosion-resistant, noncombustible wire mesh with the mesh opening not to exceed nominal 6.3 mm ($\frac{1}{4}$ in.) in size.

8.2.3 Eaves shall be boxed in with 15.8 mm ($\frac{5}{8}$ in.) nominal sheathing or noncombustible materials.

8.3 Overhanging Projections.

Porches, decks, balconies, and similar overhanging projections shall be constructed of heavy timber, as defined by local building standards, a 1-hour fire-resistive-rated assembly, or noncombustible materials.

8.4 Overhanging Buildings.

The underside of overhanging buildings shall be constructed of heavy timber, as defined by local building standards, 2-hour fire-resistive-rated material, or noncombustible materials.

8.5 Exterior Vertical Walls.

Exterior vertical walls shall be constructed of heavy timber, as defined by local building

standards, or by a 20-minute fire-resistive-rated assembly on exterior walls potentially exposed to a wildland fire unless the wildland fire risk and hazard severity assessment requires greater protection.

8.6 Exterior Openings.

8.6.1 Exterior windows and glazed doors, windows within exterior doors, and skylights shall be tempered glass, multilayered glazed panels, glass block, or have a fire-resistance rating of no less than 20 minutes.

8.6.2 Exterior doors shall be approved noncombustible construction, solid core wood no less than 44.5 mm (1.75 in.) thick, or have a fire protection rating of no less than 20 minutes.

8.6.3 Attic and Sub-Floor Ventilation. Vents shall be screened with a corrosion-resistant, noncombustible wire mesh with the mesh opening not to exceed nominal 6.35 mm (¼ in.) in size.

8.7 Chimneys and Flues.

8.7.1 Outlet Screen. Every fireplace and wood stove chimney and flue shall be provided with an approved spark arrestor constructed of a minimum 12-gauge welded wire or woven wire mesh, with the openings not to exceed 12.7 mm (½ in.).

8.7.2 Clearance. Vegetation shall not be allowed within 3.048 m (10 ft) of a chimney outlet.

8.8 Accessory Structure(s).

Outbuildings, patio covers, gazebos, and other accessory structures shall be constructed to meet the requirements of this chapter or shall be separated from the main structure by a minimum of 9.14 m (30 ft).

8.9 Mobile and Manufactured Homes.

8.9.1 Permanently located mobile and manufactured homes installed with a space beneath shall have a skirt installed and maintained of noncombustible materials or a 20-minute fire-resistive-rated assembly.

8.9.2 This enclosed space shall be vented according to 8.2.2.

Chapter 9 Fire Protection During Construction

9.1 General Requirements.

The provisions of NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, shall apply in addition to the specific requirements of this section.

9.1.1 Before the infrastructure is installed, and prior to the location and construction of building or portion thereof, fire protection plans shall be submitted to and approved by the authority having jurisdiction.

9.1.2 Prior to the delivery of combustible materials and any building construction, the water supply for fire protection, either temporary or permanent and acceptable to the authority having jurisdiction shall be made available.

9.1.3 Prior to building, occupancy-required permanent water supply for fire protection, including fire hydrants and fire suppression systems, shall be operable.

9.1.4 Fire department vehicular access to all structures under construction shall be provided at all times.

9.1.5 Combustible trash and debris shall be placed completely within an approved container or removed from the site at the close of each working day.

9.1.6 Flammable or combustible liquids shall be stored, handled, or used on the construction site in accordance with the applicable provision of NFPA 30, *Flammable and Combustible Liquids Code*, and NFPA 58, *Liquefied Petroleum Gas Code*.

9.2 Extinguishing Equipment.

9.2.1 At least one portable fire extinguisher having a rating of at least 4-A-30-BC shall be within a travel distance of 23 m (75 ft) or less to any point of a structure under construction.

9.2.2 Personnel normally on the construction site shall be instructed in the use of the fire extinguishers provided.

9.2.3 At least one dedicated, identified, minimum 19-mm ($\frac{3}{4}$ -in.) charged hose, equipped with a twist-type adjustable nozzle, shall be provided for extinguishment of vegetative fuels.

9.2.4 Hose shall be of such length or in such quantity so that nozzle streams shall reach 6.1 m (20 ft) into the vegetative fuels immediately adjacent to the construction site.

Chapter 10 Community Planning for Protection of Life and Property from Wildland Fire

10.1 General.

10.1.1 The authority having jurisdiction shall be responsible for the adoption and maintenance of a multi-agency operational plan for the protection of lives and property during wildland fires.

10.1.2 The primary goal of the plan shall be to protect people in the fire area, including emergency personnel responding to the incident, from injury or loss of life.

10.1.3 A secondary objective shall be to minimize or eliminate property loss from wildland fire.

10.2 Operational Plan.

The plan shall contain, as a minimum, command, training, community notification and involvement, public safety, and evacuation and mutual assistance elements.

Copyright NFPA

10.2.1 Command Element.

10.2.1.1 The plan shall contain a command element that clearly defines the responsibilities and authorities of all agencies and organizations that will be used in management of the incident.

10.2.1.2 Supporting resources such as social service agencies, local media, law enforcement, and so forth shall be included.

10.2.1.3 An incident system shall be used in accordance with NFPA 1561, *Standard on Emergency Services Incident Management System*.

10.2.2 Training Element.

10.2.2.1 Training, qualification, and equipment requirements shall be prepared to ensure that all personnel and equipment assigned to a wildland fire incident will be able carry out assignments in a predictable, safe, cooperative, and effective manner.

10.2.2.2 Preparation shall be appropriate for national, state, provincial, or local certification where required.

10.2.3 Community Notification and Involvement Element. Public preparation shall include the following:

- (1) The establishment of a communication system to provide rapid and accurate information to the public regarding wildland fire incidents that endanger their community, including detailed instructions for public notification of impending evacuation
- (2) Information regarding actions to be taken for self-protection
- (3) Information regarding appropriate assistance that can be rendered by the public to fire protection agencies in the management of wildland fires
- (4) Security measures to protect evacuated area

10.2.4 Public Fire Safety Information and Education.

10.2.4.1 The authority having jurisdiction shall prepare and implement a fire safety public information and education program with emphasis on wildland/urban interface and intermix issues.

10.2.4.2 The program, at a minimum, shall identify and analyze the following:

- (1) Wildland fire hazards
- (2) Life and property risks
- (3) Fire causes
- (4) Prevention and safety programs
- (5) Target audiences
- (6) Activities

10.2.5 Public Safety and Evacuation Element.

10.2.5.1 A public safety and evacuation element shall provide for the safety of residents and area workers threatened by potential wildland fire.

10.2.5.2 The public safety and evacuation element shall include the following:

- (1) Incident personnel authority and criteria for ordering evacuations
- (2) Incident personnel responsibilities in evacuations
- (3) Public notification of impending evacuations
- (4) Routes for evacuations
- (5) Shelter locations
- (6) Policy addressing the issue of persons who remain to protect their property and shelter-in-place
- (7) Procedures for allowing evacuees to return when the current fire threat has passed

10.2.6 Mutual Assistance Element.

10.2.6.1 Mutual assistance (mutual aid) agreements shall be developed that detail those services and resources available to support the management of wildland fire incident.

10.2.6.2 Mutual assistance agreements shall be reviewed annually.

10.2.6.3 Mutual assistance agreements shall include the following:

- (1) Legal authorities
- (2) Command organization
- (3) Fiscal responsibilities
- (4) Operational and logistical responsibilities

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate

standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.3 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.14 Fuels. Wildland fire fuels are described in two basic fuel model classifications, the National Forest Fire Laboratory (NFFL) or Fire Behavior Fuel Models and National Fire Danger Rating System (NFDRS).

A.3.3.22 Slope. Slope (or percent of slope) is calculated by dividing the vertical rise (or fall) of a surface for every 30.48 m (100 ft) of horizontal distance.

A.4.2 Figure A.4.2 has been developed by the NFPA Technical Committee for Forest and Rural Fire Protection to incorporate elements and ratings previously listed in NFPA 299, *Standard for Protection of Life and Property from Wildfire*, and information gathered from research and application in Firewise Community Planning Workshops, sponsored by the National Wildland/Urban Interface Fire Program, jointly sponsored by the USDA Forest Service, the Department of the Interior, the National Association of State Foresters, the National Fire Protection Association, and the US Fire Administration/FEMA.

WILDLAND FIRE RISK AND HAZARD SEVERITY ASSESSMENT FORM

Assign a value to the most appropriate element in each category and place the number of points in the column on the right.

Element	Points	
A. Means of Access		
1. Ingress and egress		
a. Two or more roads in/out	0	
b. One road in/out	7	
2. Road width		
a. ≥7.3 m (24 ft)	0	
b. ≥6.1 m (20 ft) and <7.3 m (24 ft)	2	
c. <6.1 m (20 ft)	4	
3. All-season road condition		
a. Surfaced road, grade <5%	0	
b. Surfaced road, grade >5%	2	
c. Non-surfaced road, grade <5%	2	
d. Non-surfaced road, grade >5%	5	
e. Other than all-season	7	
4. Fire Service Access		
a. ≤91.4 m (300 ft) with turnaround	0	
b. >91.4 m (300 ft) with turnaround	2	
c. <91.4 m (300 ft) with no turnaround	4	
d. ≥91.4 m (300 ft) with no turnaround	5	
5. Street signs		
a. Present [10.2 cm (4 in.) in size and reflectorized]	0	
b. Not present	5	
B. Vegetation (Fuel Models)		
1. Characteristics of predominate vegetation within 91.4 m (300 ft)		
a. Light (e.g., grasses, forbs, sawgrasses, and tundra) NFDRS Fuel Models A, C, L, N, S, and T	5	
b. Medium (e.g., light brush and small trees) NFDRS Fuel Models D, E, F, H, P, Q, and U	10	
c. Heavy (e.g., dense brush, timber, and hardwoods) NFDRS Fuel Models B, G, and O	20	
d. Slash (e.g., timber harvesting residue) NFDRS Fuel Models J, K, and L	25	
2. Defensible space		
a. More than 30.48 m (100 ft) of vegetation treatment from the structure(s)	1	
b. 21.6 m to 30.48 m (71 ft to 100 ft) of vegetation treatment from the structure(s)	3	
c. 9.14 m to 21.3 m (30 ft to 70 ft) of vegetation treatment from the structure(s)	10	
d. <9.14 m (30 ft) of vegetation treatment from the structure(s)	25	
C. Topography Within 91.4 m (300 ft) of Structure(s)		
1. Slope <9%	1	
2. Slope 10% to 20%	4	
3. Slope 21% to 30%	7	
4. Slope 31% to 40%	8	
5. Slope >41%	10	

FIGURE A.4.2 Example of Hazard Assessment Form

Element	Points											
D. Additional Rating Factors (rate all that apply)												
1. Topographical features that adversely affect wildland fire behavior	0-5	_____										
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations (e.g., heavy lightning, railroads, escaped debris burning, and arson)	0-5	_____										
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	0-5	_____										
4. Separation of adjacent structures that can contribute to fire spread	0-5	_____										
E. Roofing Assembly												
1. Class A roof	0	_____										
2. Class B roof	3	_____										
3. Class C roof	15	_____										
4. Nonrated	25	_____										
F. Building Construction												
1. Materials (predominate)												
a. Noncombustible/fire-resistive siding, eaves, and deck (<i>see Chapter 8</i>)	0	_____										
b. Noncombustible/fire-resistive siding and combustible deck	5	_____										
c. Combustible siding and deck	10	_____										
2. Building setback relative to slopes of 30% or more												
a. ≥9.14 m (30 ft) to slope	1	_____										
b. <9.14 m (30 ft) to slope	5	_____										
G. Available Fire Protection												
1. Water source availability												
a. Pressurized water source availability												
1892.7 L/min (500 gpm) hydrants ≤304.8 m (1000 ft) apart	0	_____										
946.4 L/min (250 gpm) hydrants ≤304.8 m (1000 ft) apart	1	_____										
b. Nonpressurized water source availability (off site)												
≥946.4 L/min (250 gpm) continuous for 2 hours	3	_____										
<946.4 L/min (250 gpm) continuous for 2 hours	5	_____										
c. Water unavailable	10	_____										
2. Organized response resources												
a. Station ≤8 km (5 mi.) from structure	1	_____										
b. Station >8 km (5 mi.) from structure	3	_____										
3. Fixed fire protection												
a. NFPA 13, 13R, 13D sprinkler system	0	_____										
b. None	5	_____										
H. Placement of Gas and Electric Utilities												
1. Both underground	0	_____										
2. One underground, one aboveground	3	_____										
3. Both aboveground	5	_____										
I. Totals for Home or Subdivision (Total of all points)												
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;">Hazard Assessment</th> <th style="text-align: left;">Total Points</th> </tr> </thead> <tbody> <tr> <td>Low hazard</td> <td><40</td> </tr> <tr> <td>Moderate hazard</td> <td>40-69</td> </tr> <tr> <td>High hazard</td> <td>70-112</td> </tr> <tr> <td>Extreme hazard</td> <td>>112</td> </tr> </tbody> </table>			Hazard Assessment	Total Points	Low hazard	<40	Moderate hazard	40-69	High hazard	70-112	Extreme hazard	>112
Hazard Assessment	Total Points											
Low hazard	<40											
Moderate hazard	40-69											
High hazard	70-112											
Extreme hazard	>112											

(NFPA 1144, 2 of 2)

FIGURE A.4.2 Continued

Table A.4.2 is another example of a hazard assessment rating system. An overall wildland fire hazard severity rating of low is to be given when two “L”s are assigned (slope rating and
Copyright NFPA

combustibility rating). A moderate wildland fire hazard severity rating is to be given when either of the two ratings is “M” (i.e., L/M or M/M). A high rating is assigned when either rating is “H” (i.e., M/H or H/H). See Table A.4.2.

Figure A.4.2 and Table A.4.2 depict two different approaches to conducting a wildfire hazard severity analysis. Figure A.4.2 is a format adopted by the Colorado State Forest Service and modified by the NFPA Forest and Rural Fire Protection Technical Committee to incorporate elements and ratings previously listed in NFPA 299, *Standard for Protection of Life and Property from Wildfire*, 1991 edition. Table A.4.2 is a wildfire hazard severity analysis summary developed by the NFPA Forest and Rural Fire Protection Technical Committee based upon a combination of several fire hazard severity analyses.

Table A.4.2 Wildland Fire Hazard Severity Classification Analysis by Fuel Type, Slope, and Building Material

NFDRS Fuel Models	FBO Fuel Models	Slope Percent ¹			Building Material Combustibility ²
		0–20%	21–40%	41+%	
H, R	8 Grass	L	L	M	L or M or H
U, P, E	9 Timber	L	L	M	L or M or H
K	11 Slash	L	M	H	L or M or H
A, L, S	1 Grass	L	M	H	L or M or H
D	7 Shrub	L	M	H	L or M or H
N	3 Grass	M	M	H	L or M or H
G	10 Timber	M	M	H	L or M or H
F	5 Shrub	M	M	H	L or M or H
C, T	2 Grass	M	M	H	L or M or H
F, Q	6 Shrub	M	H	H	L or M or H
J	12 Slash	M	H	H	L or M or H
I	13 Slash	M	H	H	L or M or H
B, O	4 Shrub	H	H	H	L or M or H

¹Wildland fire hazard ratings are as follows: L = low; M = moderate; or H = high.

²Building material combustibility ratings are as follows:

L = Low (Class A roof; noncombustible siding and deck).

M = Moderate (Class B roof; noncombustible siding and deck).

H = High (Class C or nonrated roof; combustible siding and deck).

A.4.2.2.2 Figure A.4.2.2.2 describes the physical similarities of NFDRS fuel models with fire behavior fuel models.

FIGURE A.4.2.2.2 Sample of a Physical Description Similarity Chart of NFDRS and FBO Fuel Models.

A.4.2.2.4 Refer to A.4.2.2.2 for the effect of slope when combined with vegetative fuel types and construction factors.

A.4.2.2.7 These additional factors can be positive (reducing risk) or negative (increasing risk) in the overall rating. Table A.4.2.2.7 is a summation of typical desirable characteristics found in various wildfire hazard analyses.

Table A.4.2.2.7 Defensible Space Clearing and Structural Summary

Low	Moderate	High
9.14 m (30 ft) clearance	9.14 m (30 ft) irrigated	9.14 m (30 ft) irrigated
Class C roof	Class B roof	Class A roof
No portion of trees or other vegetation within 3.048 m (10 ft) of chimney outlets	Noncombustible siding/wood decks	30.48 m (100 ft) fuel treatment
Trees within defensible space shall be pruned to minimize ladder fuels.	Selected fire-resistant trees within 9.1 m (30 ft) of structures Trees within defensible space shall be pruned to minimize ladder fuels.	Noncombustible siding/decks, and boxed eaves Selected fire-resistant trees within 9.1 m (30 ft) of structures
	No portion of trees or other vegetation within 3.048 m (10 ft) of chimney outlets	Selected thinning of trees and shrubs Trees within defensible space shall be pruned to minimize ladder fuels. All trees and shrubs pruned of dead material No portion of trees or other vegetation within 3.48 m (10 ft) of chimney outlets

Note: This summary does not include all the requirements listed in this standard.

A.5.1.7 See Figure A.5.1.7.

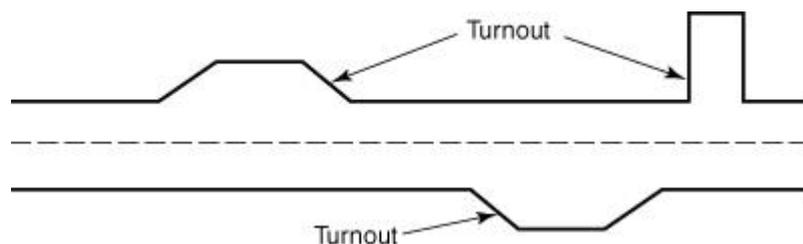


FIGURE A.5.1.7 Examples of Acceptable Turnouts.

A.5.2.3 See Figure A.5.1.7 and Figure A.5.2.3.

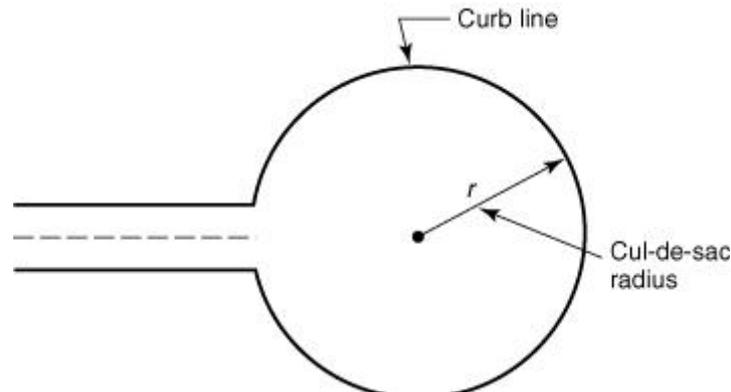


FIGURE A.5.2.3 Cul-de-Sac Radius Measurement for Fire Apparatus Turns.

A.5.6.1 The United States Postal Service and regional “911” emergency services systems could have requirements for these signs. All such signs should be coordinated with Section 5.6.

A.6.2.1 Acceptable methods of fuel treatment include prescribed burning by qualified personnel, mowing, mulching, converting to compost, and grazing.

A.8.1.2 Figure A.8.1.2 illustrates how setback is measured.

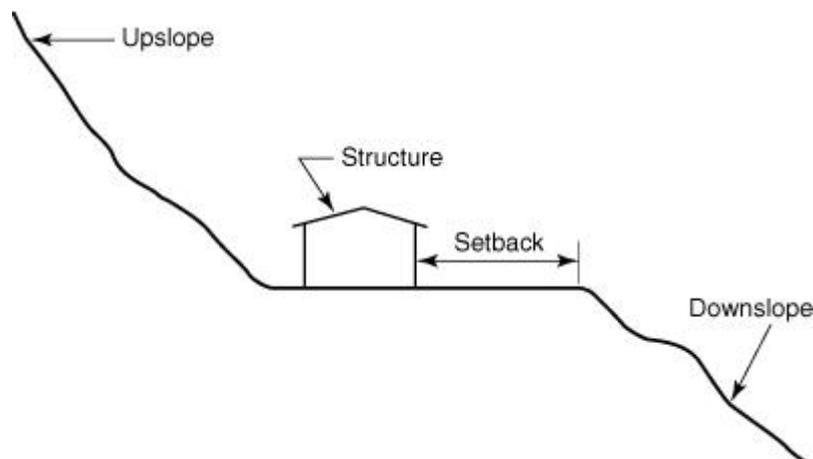


FIGURE A.8.1.2 Setback Measurement from the Structure to the Edge of the Predominate Slope.

A.8.2 Roof covering assemblies are tested for the following three levels of fire exposure:

- (1) Severe (Class A)
- (2) Moderate (Class B)
- (3) Light (Class C)

The following descriptions of the expected performance of roofs meeting those class standards is based on UL Standard 790, *Tests for Fire Resistance of Roof Covering Materials*:

- (1) *Class A roof coverings.* Class A roof coverings are tested against severe fire exposures. Under such exposures, roof coverings of this class are fire-retardant, afford a fairly high degree of fire protection to the roof deck, do not slip from position, and pose no flying-brand hazard.
- (2) *Class B roof coverings.* Class B roof coverings are tested against moderate fire exposures. Under such exposures, roof coverings of this class are fire-retardant, afford a moderate degree of fire protection to the roof deck, do not slip from position, and pose no flying-brand hazard.
- (3) *Class C roof coverings.* Class C roof coverings are tested against light fire exposures. Under such exposures, roof coverings of this class are fire-retardant, afford a measurable degree of fire protection to the roof deck, do not slip from position, and pose no flying-brand hazard.

It is important to realize that the roofs tested are installed in a very specific manner. For this reason the class ratings should be thought of as roof covering assembly tests. In other words, in order to meet the standard at which it is rated, a roof covering material should be installed in the same manner as is described in its listing.

A.8.2.2 Vents should be located in walls that do not face slopes or heavy fuels.

Annex B Fuel Model Classifications

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

The following is an excerpt from the National Fire Danger Rating System (NFDRS) from the U.S. Department of Agriculture, Forest Service, General Technical Report INT-39. This material is provided for informational purposes, and is not intended for adoption.

B.1 General.

The fuel model keys that follow are only general descriptions because they represent all wildland fire fuels from Florida to Alaska and from the East Coast to California.

FUEL MODEL KEY

- I. Mosses, lichens, and low shrubs predominate ground fuels.
 - A. An overstory of conifers occupies more than one-third of the site: MODEL Q.
 - B. There is no overstory, or it occupies less than one-third of the site (tundra): MODEL S.
- II. Marsh grasses and/or reeds predominate: MODEL N.
- III. Grasses and/or forbs predominate.
 - A. There is an open overstory of conifer and/or hardwood trees: MODEL C.
 - B. There is no overstory.

1. Woody shrubs occupy more than one-third, but less than two-thirds of the site:
MODEL T.

2. Woody shrubs occupy less than one-third of the site:

a. The grasses and forbs are primarily annuals: MODEL A.

b. The grasses and forbs are primarily perennials: MODEL L.

IV. Brush, shrubs, tree reproduction, or dwarf tree species predominate.

A. Average height of woody plants is 6 ft (1.8 m) or greater.

1. Woody plants occupy two-thirds or more of the site.

a. One-fourth or more of the woody foliage is dead.

(1) Mixed California chaparral: MODEL B.

(2) Other types of brush: MODEL F.

b. Up to one-fourth of the woody foliage is dead: MODEL Q.

c. Little dead foliage: MODEL O.

2. Woody plants occupy less than two-thirds of the site: MODEL F.

B. Average height if woody plants are less than 6 ft (1.8 m).

1. Woody plants occupy two-thirds or more of the site.

a. Western United States: MODEL F.

b. Eastern United States: MODEL O.

2. Woody plants occupy less than two-thirds but greater than one-third of the site.

a. Western United States: MODEL T.

b. Eastern United States: MODEL D.

3. Woody plants occupy less than one-third of the site.

a. The grasses and forbs are primarily annuals: MODEL A.

b. The grasses and forbs are primarily perennials: MODEL L.

V. Trees predominate.

A. Deciduous broadleaf species predominate.

1. The area has been thinned or partially cut, leaving slash as the major fuel component: MODEL K.

2. The area has not been thinned or partially cut.

a. The overstory is dormant; the leaves have fallen: MODEL E.

b. The overstory is in full leaf: MODEL R.

B. Conifer species predominate.

1. Lichens, mosses, and low shrubs dominate as understory fuels: MODEL Q.
2. Grasses and forbs are the primary ground fuels: MODEL C.
3. Woody shrubs and/or reproduction dominate as understory fuels.
 - a. The understory burns readily.
 - (1) Western United States: MODEL T.
 - (2) Eastern United States:
 - (a) The understory is more than 6 ft (1.8 m) tall: MODEL O.
 - (b) The understory is less than 6 ft (1.8 m) tall: MODEL D.
 - b. The understory seldom burns: MODEL H.
4. Duff and litter, branchwood, and tree boles are the primary ground fuels.
 - a. The overstory is overmature and decadent; there is a heavy accumulation of dead tree debris: MODEL G.
 - b. The overstory is not decadent; there is only a nominal accumulation of debris.
 - (1) The needles are 2 in. (5.1 cm) or more in length (most pines).
 - (a) Eastern United States: MODEL P.
 - (b) Western United States: MODEL U.
 - (2) The needles are less than 2 in. (5.1 cm) long: MODEL H.

VI. Slash is the predominant fuel.

A. The foliage is still attached; there has been little settling.

1. The loading is 25 tons/acre (56.1+/ha) or greater: MODEL I.
2. The loading is less than 25 tons/acre (56.1 tons/ha) but more than 15 tons/acre (33.6+/ha): MODEL J.
3. The loading is less than 15 tons/acre (33.6+/ha): MODEL K.

B. Settling is evident; the foliage is falling off; grasses, forbs, and shrubs are invading the area.

1. The loading is 25 tons/acre (56.1+/ha) or greater: MODEL J.
2. The loading is less than 25 tons/acre (56.1+/ha): MODEL K.

B.2 Fuel Models

B.2.1 Fuel Model A. This fuel model represents western grasslands vegetated by annual grasses and forbs. Brush or trees can be present but are very sparse, occupying less than a third of the area. Examples of types where Fuel Model A should be used are cheatgrass and

medusahead. Open pinyon-juniper, sage-brush-grass, and desert shrub associations can appropriately be assigned this fuel model if the woody plants meet the density criteria. The quantity and continuity of the ground fuels vary greatly with rainfall from year to year.

B.2.2 Fuel Model B. Mature, dense fields of brush 1.83 m (6 ft) or more in height are represented by this fuel model. One-fourth or more of the aerial fuel in such stands is dead. Foliage burns readily. Model B fuels are potentially very dangerous, fostering intense, fast-spreading fires. This model is for California mixed chaparral generally 30 years or older. The F model is more appropriate for pure chamise stands. The B model can also be used for the New Jersey Pine barrens.

B.2.3 Fuel Model C. Open pine stands typify Model C fuels. Perennial grasses and forbs are the primary ground fuel, but there is enough needle litter and branchwood present to contribute significantly to the fuel loading. Some brush and shrubs can be present but they are of little consequence. Situations covered by Fuel Model C are open, longleaf, slash, ponderosa, Jeffrey, and sugar pine stands. Some pinyon-juniper stands might qualify.

B.2.4 Fuel Model D. This fuel model is specifically for the palmetto-gallberry understory-pine overstory association of the southeast coastal plains. It can also be used for the so-called “low Pocosins” where Fuel Model O might be too severe. This model should only be used in the Southeast because of a moisture of extinction.

B.2.5 Fuel Model E. Use this model after leaf fall for hardwood and mixed hardwood-conifer types where the hardwoods dominate. The fuel is primarily hardwood leaf litter. The oak-hickory types are best represented by Fuel Model E, but E is an acceptable choice for northern hardwoods and mixed forests of the Southeast. In high winds, the fire danger might be underrated because rolling and blowing leaves are not accounted for. In the summer after the trees have leafed out, Fuel Model E should be replaced by Fuel Model R.

B.2.6 Fuel Model F. Fuel Model F is the only one of the 1972 NFDR System Fuel Models whose application has changed. Model F now represents mature closed chamise stands and oakbrush fields of Arizona, Utah, and Colorado. It also applies to young, closed stands and mature open stands of California mixed chaparral. Open stands of pinyon-juniper are represented; however, fire activity will be overrated at low wind speeds and where there are sparse ground fuels.

B.2.7 Fuel Model G. Fuel Model G is used for dense conifer stands where there is a heavy accumulation of litter and downed woody material. Such stands are typically overmature and might also be suffering insect, disease, wind, or ice damage — natural events that create a very heavy buildup of dead material on the forest floor. The duff and litter are deep and much of the woody material is more than 3 in. (7.6 cm) in diameter. The undergrowth is variable, but shrubs are usually restricted to openings. Types represented by Fuel Model G include hemlock-Sitka spruce, Coast Douglas-fir, and wind-thrown or bug-killed stands of lodgepole pine and spruce.

B.2.8 Fuel Model H. The short-needled conifers (white pines, spruces, larches, and firs) are represented by Fuel Model H. In contrast to Model G fuels, Fuel Model H describes a healthy stand with sparse undergrowth and a thin layer of ground fuels. Fires in H fuels are typically slow spreading and are dangerous only in scattered areas where the downed woody

material is concentrated.

B.2.9 Fuel Model I. Fuel Model I was designed for clear-cut conifer slash where the total loading of materials less than 6 in. (15.2 cm) in diameter exceeds 25 tons/acre (56.1+/ha). After settling and the fines (needles and twigs) fall from the branches, Fuel Model I will overrate the fire potential. For lighter loadings of clear-cut conifer slash, use Fuel Model J, and for light thinnings and partial cuts where the slash is scattered under a residual overstory, use Fuel Model K.

B.2.10 Fuel Model J. This model is complementary to Fuel Model I. It is for clear-cuts and heavily thinned conifer stands where the total loading of materials less than 6 in. (15.2 cm) in diameter is less than 25 tons/acre (56.1+/ha). Again, as the slash ages, the fire potential will be overrated.

B.2.11 Fuel Model K. Slash fuels from light thinnings and partial cuts in conifer stands are represented by Fuel Model K. Typically, the slash is scattered about under an open understory. This model applies to hardwood slash and to southern pine clear-cuts where the loading of all fuels is less than 15 tons/acre (33.6+/ha).

B.2.12 Fuel Model L. This fuel model is meant to represent western grasslands vegetated by perennial grasses. The principal species are coarser and the loadings heavier than those of Model A fuels. Otherwise, the situations are very similar; shrubs and trees occupy less than one-third of the area. The quantity of fuel in these areas is more stable from year to year. In sagebrush areas, Fuel Model T could be more appropriate.

B.2.13 Fuel Model N. This fuel model was constructed specifically for the sawgrass prairies of south Florida. It can be useful in other marsh situations where the fuel is coarse and reed-like. This model assumes that one-third of the aerial portion of the plants is dead. Fast-spreading, intense fires can occur even over standing water.

B.2.14 Fuel Model O. The O fuel model applies to dense, brush-like fuels of the Southeast. O fuels, except for a deep litter layer, are almost entirely living, in contrast to B fuels. The foliage burns readily, except during active growing season. The plants are typically over 1.8 m (6 ft) tall and are often found under an open stand of pine. The high Pocosins of the Virginia, North Carolina, and South Carolina coasts are the ideal of Fuel Model O. If the plants do not meet the 1.8-m (6-ft) criteria in those areas, Fuel Model D should be used.

B.2.15 Fuel Model P. Closed, thrifty stands of long-needled southern pines are characteristic of P fuels. A 5.06 to 10.12 cm (2 to 4 in.) layer of lightly compacted needle litter is the primary fuel. Some small-diameter branchwood is present but the density of the canopy precludes more than a scattering of shrubs and grass. Fuel Model P has the high moisture of extinction characteristic of the Southeast. The corresponding model for other long-needled pines is U.

B.2.16 Fuel Model Q. Upland Alaskan black spruce is represented by Fuel Model Q. The stands are dense but have frequent openings filled with usually flammable shrub species. The forest floor is a deep layer of moss and lichens, but there is some needle litter and small-diameter branchwood. The branches are persistent on the trees, and ground fires easily reach into the tree crowns. This fuel model can be useful for jack pine stands in the Lake

States. Ground fires are typically slow spreading, but a dangerous crowning potential exists.

B.2.17 Fuel Model R. This fuel model represents the hardwood areas after the canopies leaf out in the spring. It is provided as the off-season substitute for E. It should be used during the summer in all hardwood and mixed conifer-hardwood stands where more than half of the overstory is deciduous.

B.2.18 Fuel Model S. Alaskan or alpine tundra on relatively well-drained sites characterize the S fuel model. Grass and low shrubs are often present, but the principal fuel is a deep layer of lichens and moss. Fires in these fuels are not fast spreading or intense, but are difficult to extinguish.

B.2.19 Fuel Model T. The bothersome sagebrush-grass types of the Great Basin and the Intermountain West are characteristic of T fuels. The shrubs burn easily and are not dense enough to shade out grass and other herbaceous plants. The shrubs must occupy at least one-third of the site or the A or L fuel models should be used. Fuel Model T might be used for immature scrub oak and desert shrub associations in the West, and the scrub oak-wire grass type in the Southeast.

B.2.20 Fuel Model U. Closed stands of western long-needled pines are covered by this model. The ground fuels are primarily litter and small branchwood. Grass and shrubs are precluded by the dense canopy but occur in the occasional natural opening. Fuel Model U should be used for ponderosa, Jeffrey, sugar pine, and red pine stands of the Lake States. Fuel Model P is the corresponding model for southern pine plantations.

Annex C Informational References

C.1 Referenced Publications.

The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not part of the requirements of this document unless also listed in Chapter 2.

C.1.1 NFPA Publications. (Reserved)

C.1.2 Other Publications.

C.1.2.1 UL Publication. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL Standard 790, *Tests for Fire Resistance of Roof Covering Materials*, 1997.

C.1.2.2 U.S. Government Publication. U.S. Government Printing Office, Washington, DC 20402.

National Fire Danger Rating System (NFDRS), revised edition 1988, U.S. Department of Agriculture, Forest Service, General Technical Report INT-39.

C.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. Copyright NFPA

They are not a part of the requirements of this document.

C.2.1 Publications.

Anderson, Hal E., 1982. *Aids to Determining Fuel Models For Estimating Fire Behavior*. General Technical Report INT-122. Ogden, UT 84401: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Community Emergency Response Teams, Oregon Department of Forestry, Klamath Lake District, Klamath Falls, OR.

Development Strategies in the Wildland/Urban Interface, 1991, Western Fire Chiefs Association: WFCA Press, Ontario, CA.

Fire Department Planning for Operations in Wildland/Urban Interface Fires, Georgia Forestry Commission.

Firefighter's Handbook on Wildland Fire Fighting, 1994, William C. Teie, Deer Valley Press, Rescue, CA.

Fire Officers Handbook on Wildland Fire Fighting, 1997, William C. Teie, Deer Valley Press, Rescue, CA.

Fire Hazard Rating: For Existing Wildland Residential Developments or Single Structures in Montana, Montana Department of State Lands, Missoula, MT 59801.

Fireline Handbook 3, National Interagency Fire Center, Boise, ID.

Fire Safe Guides for Residential Development in California, 1980, California Department of Forestry and Fire Protection, P.O. Box 94244, Sacramento, CA 94244-2460.

Glossary of Wildland Fire Management Terms Used in the United States, 1990, Society of American Foresters, 5400 Grosvenor Lane, Washington, DC 20014.

Protecting Residences from Wildfires: A Guide for Homeowners, Lawmakers and Planners, Howard E. Moore, General Technical Report PSW-50, United States Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1960 Addison St., Berkeley, CA 94704.

Sierra Front Classification Procedures, Forest Supervisor, Toiyabe National Forest, 1200 Franklin Way, Sparks, NV 89431.

Wildland Fire Protection Analysis, Georgia Forestry Commission, Box 819, Macon, GA 31298.

Wildland/Urban Interface Fire Protection: A National Problem with Local Solutions, August 1988, National Fire Academy, Federal Emergency Management Agency, Washington, DC.

C.2.2 Websites

www.firewise.org This website is supported through the National Wildland/Urban Interface Fire Program, sponsored by a multi-agency public–private partnership. It contains information for fire officials and homeowners on living safer in interface, interactive guides,

Copyright NFPA

publications, and streaming video. The site features Firewise Communities activities (e.g., regional workshops, training materials, state-by-state lists of available materials, and resources for planning). Links to other related sites are also provided.

www.nwcg.gov This website supports the activities of the National Wildfire Coordinating Group. The purpose of NWCG is to establish an operational group designed to coordinate programs of the participating federal and state wildfire management agencies so as to avoid wasteful duplication and to provide a means of constructively working together. Its goal is to provide more effective execution of each agency's fire management program. Information on the activities of the NWCG and its program working teams is available.

www.ucfpl.ucop.edu/prefire This is the website of the University of California's Forest Products Laboratory. The site features information about the research conducted by the Laboratory and wildland/urban interface fire mitigation recommendations from the California State Fire Marshal's Office in 1996, as well as new information on fire hazard mitigation.

C.3 References for Extracts.

The following documents are listed here to provide reference information, including title and edition, for extracts given throughout this standard as indicated by a reference in brackets [] following a section or paragraph. These documents are not a part of the requirements of this document unless also listed in Chapter 2 for other reasons.

NFPA 101®, *Life Safety Code*®, 2000 edition.

NFPA 1141, *Standard for Fire Protection in Planned Building Groups*, 1998 edition.

[Click here to view and/or print an Adobe® Acrobat® version of the index for this document](#)